NOTES ON ANCIENT BRITISH MONUMENTS.[1]

VII.—THE ABERDEEN CIRCLES (*Continued*).[2]

IN December, 1906, I gave an account of my measures of four examples of a very special type of circle which is only to be found, so far as I know, in Aberdeenshire. They were described in relation to other circles by Mr. Lewis in his paper on the stone circles of Scotland. My wife and I again went to Aberdeen last autumn and measured another twenty-five, leaving, I believe, still more than a hundred to be examined.

The survey last year has greatly increased the interest in them, and I hope to show that a complete inquiry into them may advance science in many directions, especially if other allied questions are included in the research.

The instrument employed in the reconnaissance, for time did not allow of a complete survey, was a compass clinometer of Barker's pattern, giving azimuths and angular heights of the horizon, say, to half a degree, a reading quite as fine as can be hoped for, considering the rough condition of the monuments, and the presence of trees on the horizon in many cases. As I said in my 1906 notes, observations of the height of the horizon in winter, when the trees are leafless, are very desirable.

In the observations last year, the orientation was determined by attempting to find the direction of the line across the circle at right angles to the face of the recumbent stone. Last year I worked differently.

The method of observation adopted was to measure the azimuth of the line lying along the common N. and S. surfaces of the supporters and recumbent stone, and in the eastern direction where possible. When there was no common line, supporters and recumbent stone were dealt with separately. In some of the complete and undisturbed triliths the correspondence of the azimuths of both surfaces showed that immense care had been taken in selecting and "planting" the stones.

The mean of the azimuths thus obtained, deducting 90°, gave the direction of the observing line across the circle.

In some cases it seemed as if the circle builders had got this line in the first instance by erecting two stones on the opposite side of the circle about the same distance apart as the two supporters—a kind of avenue, the surfaces of the recumbent stone being placed at right angles to this line.

This premised, I next give a comparison between the Cornwall and Aberdeen monuments:—

(1) Assuming that the recumbent stone in Aberdeenshire was used as a directrix, like the outstanding stones of the Cornish and Gorsedd circles, all the conclusions I arrived at in Cornwall and on Dartmoor are abundantly confirmed.

(2) I have examined no circle in Aberdeenshire the astronomical use of which, with one or two exceptions to be referred to later, is not perfectly obvious in the light of former work.

(3) The directions indicated by the Aberdeen recumbent or directing stones are generally the same as those indicated by the outstanding stones in Cornwall. The exceptions are that the cardinal points N. true and W. true are indicated in the former.

(4) The N. and the W. true alignments may indicate an advance in astronomical knowledge. The N. alignments suggest that time at night was determined by circumpolar stars. The W. alignment shows that the equinoxes were fixed as well as the solstices.

(5) Of the twenty-nine circles I have examined, fifteen are clock-star circles, two are May-year, and three solstitial. Of special circles we have four facing N. and one facing W.

(6) Arcturus and Capella were used as clock-stars in Cornwall; in the higher latitude of Aberdeen Castor might have been used.

(7) So far, and quite provisionally until a larger number of circles is examined, I think Castor was not used.

(8) In the clock-star circles the azimuths range from N. 4° E. to N. 29° E. These azimuths, taking the heights of horizon into account, give us N. declinations from 34° 45′ to 31°. If Capella is in question, the dates lie between B.C. 1200 and B.C. 2000; if Arcturus, B.C. 950 and B.C. 250. Mean dates are:—Capella, B.C. 1600; Arcturus, B.C. 600.

I append a diagram which shows the connections existing between the azimuths, the elevation of the horizon—both measured quantities—and the declinations, and dates of the use of the clock-stars. The numbers on the curves refer to the fifteen clock-star circles enumerated below:—

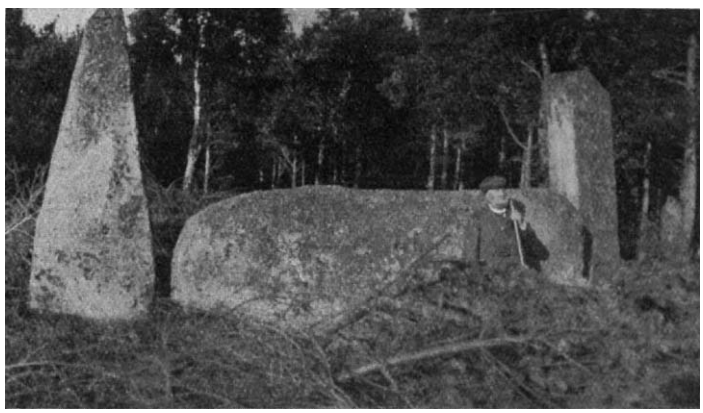

FIG. 20.—The recumbent or directing stone and supporters of the Cothie Muir Circle, a normal example.

1, Braehead Leslie; 2, Leylodge; 3, Loudon Wood; 4, Tomnagorn; 5, Wanton Wells; 6, Old Keig; 7, South Fornet; 13, Nether Boddam; 8, Aikey Brae; 9, Castle Fraser; 10, New Craig; 11, Loanhead of Daviot; 12, Kirkton of Bourtie; 14, Cothie Muir; 15, Eslie the Greater.

Note that on the diagram the circle (13) is misplaced. The azimuth should be 21° 15′, not 11° 15′; consequently the (13) circle should be moved along the "2° hill" curve until it touches the circle (5).

As an illustration of the use of the curve, take the case of the Cothie Muir circle, number 14. The true azimuth across the circle, *i.e.* at right angles to the recumbent stone, was found to be N. 18° 55′ E., and the elevation of the horizon in that direction 4°. Projecting the point where the 18° 55′ azimuth ordinate intersects the "4° hill" curve, on to the declination scale, we get 34° 42′ N. as the declination. Referring to the time scales for Arcturus and Capella, it is seen

[1] Continued from p. 416.
[2] NATURE, vol. lxxv., p. 150.

that the former had this declination in 920 B.C., the latter in 1300 B.C.

(9) There is so far no absolute demonstration as to which of the stars in question was used, or whether they were used at different times. Some light may be thrown on this point if the approximate dates of the solstitial circles at Midmar, Sunhoney and Stonehead can be determined, using the change of obliquity.

This question of date is, of course, one of surpassing interest, and it is not a little curious that the conditions at Aberdeen are such that no direct solution of the problem is so far possible.

But there are some sidelights.

Against the older date is the fact that the Aberdeen circles, even May-year circles, differ in the method of alignment used in other parts of Britain, including the west coast of Scotland, at the earlier date. But the presence of the recumbent stone is not the only difference; the central stone of the Gorsedd is generally replaced by a cairn, or rings or mounds of stones. The true N. alignments at Dyce, Whitehill Wood, Raes of Clune and Candle Hill (Insch) have no counterpart in the South, and they may be held to indicate possibly an advance in the manner of determining time at night, and therefore an erection at a more recent date.

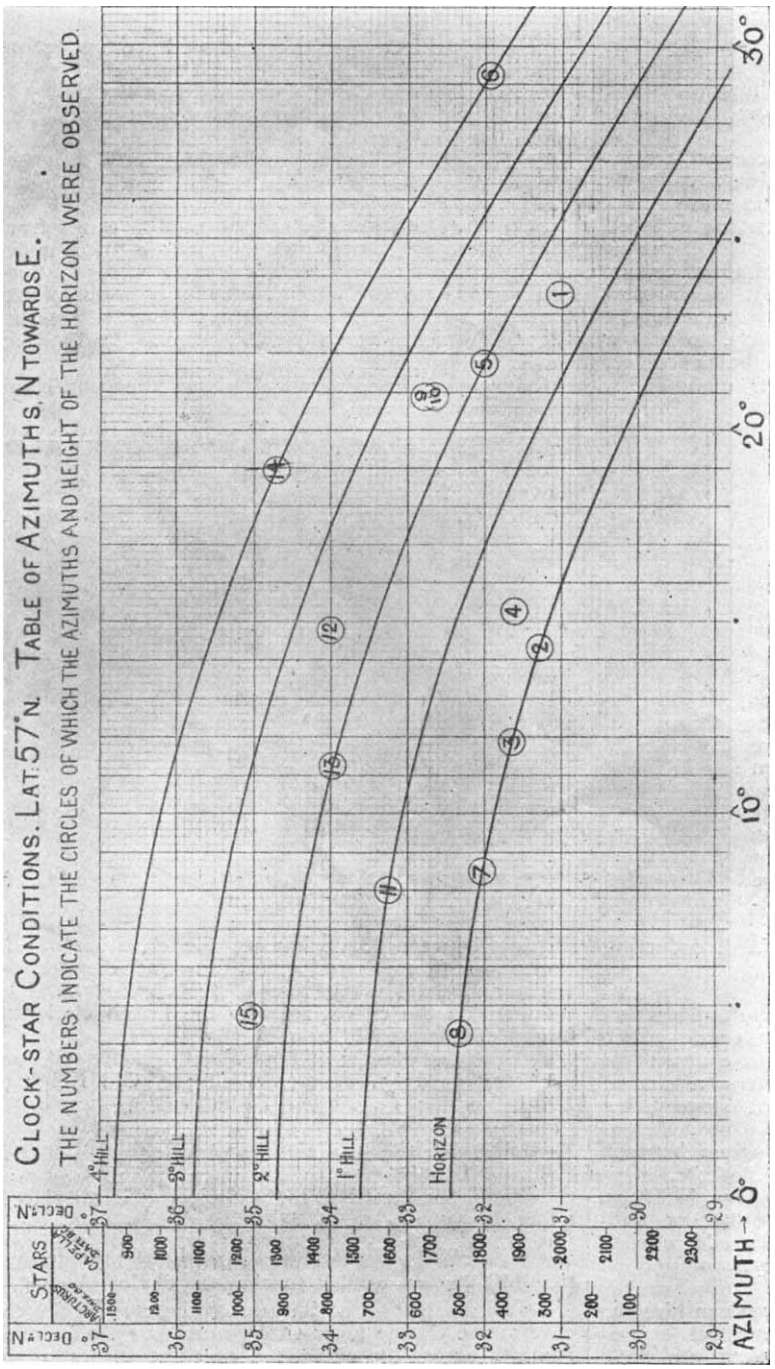

FIG. 21.—Showing azimuths and heights of hills.

Again, the work at the various circles showed that the Aberdeen system of alignment is far inferior to that of the employment of an outstanding stone some distance away from the circle as in the Cornish monuments. But it must not be taken for granted that this inferior method of alignment meant an inferior knowledge of astronomy, which we should be justified in associating with an earlier date. I am rather inclined to attribute it to the fact that an exact knowledge of the length of the year and of the number of days in each quarter having been gained, exact alignments became less necessary. As time went on, the circle became of less importance as an astronomical instrument, though its other uses remained, and this latter view seems strengthened by the fact that in Aberdeenshire the circles are very frequently located on the tops of low hills, convenient places of assembly, whereas in Cornwall this, so far as I now remember, did not often happen. The Aberdeenshire circles, indeed, are generally at a much lower level, among the cultivation. It was chiefly the astronomical requirement of a clear horizon which was fulfilled in Cornwall and Dartmoor, at heights from 1000 to 1500 feet.

Another strong argument against the older date is the absence of cromlechs in the Aberdeen district.

May we not take the absence of the cromlech and the presence of the cist as another proof of modernity? By cist I mean an obvious grave as opposed to the "chambered cairns" of some authors, which were as obviously not built as graves merely. These "chambered cairns," I take it, are really the interiors of barrows, and are large examples of cromlechs. It is immaterial whether the barrows were built of stones or earth to make the chambers rain-tight. This would depend upon which was most handy—stones

in Scotland, chalk at Stonehenge, earth in Cornwall.

Now while "cists" are common to Scotland, Dartmoor and Cornwall, the "chambered cairn" or cromlech is in Scotland special to the west coast. I do not know at present whether there is any representative of it nearer to Aberdeen than Callernish or Stenness. The difference between the east and west coast of Scotland is thus strongly emphasised, and the view of a difference of time in the building operations is strengthened.

I now return for a moment from the side-lights to the clock-star conditions, in order to give a table of the measurements, from which the declinations of the stars were determined by means of a curve connecting azimuth and declination, for different elevations of the horizon, for the general latitude of 57° N.; consequently the measurements are not final, but are sufficiently accurate for a preliminary discussion.

Between 2000 B.C. and 1 B.C Arcturus and Capella were the only first-magnitude stars to come within the declination range shown in the table, and, as my results show that they were used as clock-stars in Cornwall and Devon, I consider that the evidence in their favour warrants the assumption that one of them was used as a clock-star by the circle-builders of Aberdeenshire. I give the dates for both.

Circles at—	Azimuths		Elevation of the horizon	Declination N.	Dates B.C.	
	Magnetic, mean of observations	True, at right-angles across circle			Arcturus	Capella
	° ′	° ′	°	° ′		
Braehead Leslie... ...	132 20	N. 23 35 E.	1½	30 58	250	2000
Leylodge	123 0	N. 14 15 E.	0	31 18	330	1940
Loudon Wood	120 40	N. 11 55 E.	0	31 38	370	1890
Tomnagorn	124 0	N. 15 15 E.	½?	31 42	390	1860
Wanton Wells	130 30	N. 21 45 E.	2	31 52	420	1830
Old Keig	138 0	N. 29 15 E.	4	31 55	430	1820
South Fornet	116 48	N. 8 3 E.	0	32 4	450	1800
Nether Boddam... ..	130 0	N. 21 15 E.	2	32 8	460	1790
Aikey Brae...	113 0	N. 4 15 E.	0	32 18	500	1760
Castle Fraser	129 36	N. 20 51 E.	2½	32 42	570	1680
New Craig	129 34	N. 20 49 E.	2½	32 43	570	1680
Loanhead of Daviot...	116 45	N. 8 0 E.	1	33 14	660	1580
Kirkton of Bourtie ...	123 30	N. 14 45 E.	2½	33 57	770	1460
Cothie Muir	127 40	N. 18 55 E.	4	34 42	920	1300
Eslie the Greater ...	113 30	N. 4 45 E.	2½	35 5	980	1230

In future notes, after referring to some more "side-lights," I shall give the measurements of the May-year and solstitial circles.

NORMAN LOCKYER.

PROPOSED ALTERATION IN THE CALENDAR.

THE last great alteration in the calendar was that which was known as the Gregorian Reformation. It was promulgated in 1582, and at once accepted in all countries which were under the Roman obedience in ecclesiastical matters, but only gradually adopted by those belonging to the Reformed Western Church (which are all usually called Protestant, though that term strictly pertains to the Lutherans only), whilst the Eastern Church adheres still to the old Julian style.

Now it is often forgotten that the change then made was two-fold, the two parts having really no reference to each other, and the assertion frequently made that the Gregorian calendar was constructed, or nearly so, to agree with the astronomical length of the year, applies to only one of these changes, the other, which made a violent hiatus in the succession of days, being effected with a totally different object. For if the year were to be assigned its true length and not the $365\frac{1}{4}$ days decreed by Julius Cæsar, it would at first sight have seemed most natural to choose a convenient epoch, such as the end of a century, and simply arrange the omission of a leap-year at certain stated times from that. (Here we may parenthetically remark that a regulation to drop a leap-year at the end of each 132nd year would have been more accurate, and quite as simple as that actually adopted.) But it was also thought necessary to bring back the vernal equinox to the date it occupied, not at the Christian era, but at the time of the Council of Nicæa in the fourth century. Hence ten days were omitted from the current sequence, and when England came into line with other western countries, eleven days were omitted in 1752. This, of course, makes great care necessary in comparing events as given in English and Continental narratives between 1582 and 1752.

The change now proposed, and recently brought before the House of Commons by Mr. Pearce, is of a much more drastic kind. It is not a reformation of the Gregorian calendar as regards the length of the year (and a small change of the rule, as already mentioned, would improve its accuracy at long intervals), but a proposal to alter the succession of the days of the week and of the month to secure a degree of symmetry in their correspondence, and an equality in the four quarters of the year. Thus the first of January and the leap-year day, which, however, is to be, not in February, but in June, have each to be considered in every respect a *dies non*; if either falls on a Sunday, not that day, but the next is to be reckoned as Sunday, which, of course, would occasionally throw Sunday one day, or even two days, ahead of its place in the sequence of seven days.

Now it may safely be affirmed that, not only for its practical inconvenience and disturbance of the uniformity and continuity which are so desirable in a calendar, but for other reasons also, even more weighty, this alteration can never be accepted in Christian countries, nor could it commend itself if we began *de novo*.

As regards the days of the month, the case is different. The existing arrangement was a perversion of that decreed by Julius Cæsar. He ordained that the year should begin with January, the 1st being the day of new moon nearest the winter solstice when the change was made, and that that month should have thirty-one days and each alternate month afterwards, the rest to have thirty, excepting February, which should have twenty-nine days in common years and thirty days in leap-years, to fall *every* fourth year. In the reign of Augustus, who looked upon August as his special month, though it was not that of his birth, the convenient and easily to be remembered arrangement of Julius was altered in order that August might have as many days as July. By the earlier arrangement the days of the successive months were 31, 29 (or 30), 31, 30, 31, 30, 31, 30, 31, 30, 31, 30; by the later (now followed), 31, 28 (or 29), 31, 30, 31, 30, 31, 31, 30, 31, 30, 31.

No doubt Cæsar placed the leap-day in February because that had been the last month of the year in the old Roman calendar. There would be no harm, if we were starting afresh, in placing it in June as proposed by Mr. Pearce; but it would injure continuity (always a desirable thing in itself) and not attain his object unless the day, as well as New Year's Day, were made a *dies non*, both in the week and in the